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Marking Landing Fields

ONE of the crying needs of commercial aviation is a system of ground markings that will serve as aerial sign posts. One of the most logical places to display these markings is on landing fields and airports as they not only serve those looking for these points but also those that are merely passing overhead. To be of maximum utility such marks should conform to some uniform and simple system and should convey as much information as is practicable.

As the airplane is essentially an international means of transportation, Annex F of the International Air Convention contains provisions for a uniform system of ground marks that is admirably adapted to its purpose. The basis of this system is the International 1:1,000,000 scale map adopted by an international congress before the war. This map is divided into sheets comprising six degrees of longitude and four degrees of latitude. The ground marks consist of an open rectangle whose short sides shall be oriented north and south with the open side facing the opposite side of the unit sheet. Within this rectangle is a dot indicating the relative position of the field on that half of the unit sheet of the map. On the sides of the rectangle are figures indicating which unit sheet the field is on.

After the armistice the Air Service started a system of marking fields in this country based on the state in which the field was located. The mark consists of a letter and a serial number. This system has never been employed to any great extent. It is simply an identification and does not give any further information than the name of the field in code.

The international system on the other hand gives the navigator an indication of his position on the map without looking up the code to determine the name of the field and then finding it on the map. It may be argued that a navigator will know the meaning of the code and the position on the map. This is only true in territory that the navigator is familiar with and as aviation progresses the number of ground markings will increase greatly, rendering it more and more difficult to remember their location by some arbitrary code.

The defect of the international system lies in the lack of name of the field. If some code of letters or letters and figures were substituted for the numbers indicating the sheet, the usefulness would be proportionately increased. At large airports the name will undoubtedly be spelled out in gigantic letters but this is not practicable for every little landing field.

Automobile Laws and Aerial Laws

THE National Conference on Highway Traffic Regulations will meet in Washington on January 10 to reach final agreement on traffic regulations which can be presented with their endorsement to the country at large and particularly to the forty-two state legislatures convening that month. It is expected that the passage of these uniform laws will have the following effects:

First. To reduce deaths and injuries resulting from automobile accidents caused by ignorance or misinterpretation of traffic laws.

Second. To relieve the municipal courts which in many of the larger cities are now flooded with traffic violation cases.

Third. To save millions annually in property damage resulting from accidents due to violation or misinterpretation of traffic laws.

Fourth. To speed up traffic in the congested districts of cities by making it possible for the motorist to know what to do and what to expect from other motorists.

This represents an effort to overcome the confusion resulting from the variety of state motor laws which we are now afflicted with. It is a lesson for aviation in that it shows the bad results of a lack of federal law in a very similar field. If the word airplane be substituted for automobile, pilot for motorist, and airports for cities in the last item, this summary would be as applicable as an argument for a federal aerial traffic law.

The Need of Test Pilots

IT is a curious fact that many pilots develop an aversion for a certain type of machine without being able to state their reasons. When a statement is demanded they usually reply that the ship "doesn't feel right" and that some part "doesn't look right." It makes no difference to them if the machine has been tested in many ways they only are convinced that something is wrong somewhere.

On the other hand there are a few pilots who are able to fly a type for a time and then give a constructive criticism of the merits of the type. The majority of this small class do not seem to be particularly good pilots at first sight. They seem to be inordinately fussy and not over anxious to fly. This is a mistaken impression, they appear to be fussy because they really know what shape a machine should be in, and not over anxious to fly because they already have a great deal of flying time and more flying is just so much more work.

Many engineers are inclined to feel that comments from a pilot concerning their designs are somewhat of an insult. This is because they do not appreciate the value of a good test pilot. Aeronautical engineering can not depend absolutely on either wind tunnel or sand load tests and hence must get a final and very accurate check from flight tests. These flight tests are carried out by the test pilot and his impressions are very often of more constructive value than the data he collects. An experienced test pilot acquires a sort of intuition that tells him what will go and what will not. If his criticisms are given their proper weight in changing a design the progress of aeronautical engineering would proceed much more rapidly.

Air Service Requests $60,000,000

The Chief of Air Service has submitted to Congress its estimated requirements for the fiscal year ending June 30, 1922. The personnel required consists of 1,514 officers and 16,000 enlisted men. The financial requirements are divided into eight groups shown below, the total of which amounts to $60,000,000:

ESTIMATE FOR FISCAL YEAR ENDING JUNE 30, 1922

EXPENSES OF CIVILIAN EMPLOYES

	Operation	Experimental Stations and Research	Totals
Pay of civilians in the office of the Chief of Air Service	$ 133,550 00	$	$ 135,550 00
Pay of civilians in the field	6,856,156 00	2,612,000 00	9,468,156 00
Traveling expenses of civilians on rolls in office of the Chief of Air Service	6,500 00		6,500 00
Traveling expenses of civilians on field rolls	25,000 00	30,000 00	55,000 00
Pay of consulting engineers		4,500 00	4,500 00
Traveling expense of consulting engineers		500 00	500 00
Totals	$7,023,206 00	$2,647,000 00	$9,670,206 00

INSTRUCTION AND OPERATION OF AIR SERVICE TROOPS

	Operation	Experimental Stations and Research	Totals
Hydrogen, purchase of	$ 300,000 00	$	$ 300,000 00
Airplanes and their spare parts, maintenance and repair of	1,635,262 00	251 500 00	1,886,762 00
Airships and their spare parts, maintenance and repair of	166,700 00		166,700 00
Balloons and their spare parts, maintenance and repair of	19,450 00		19,450 00
Engines and their spare parts, M & R	1,430,213 00	100,000 00	1,530,213 00
Instruments and accessories for aircraft and engines, M & R.	75,000 00		75,000 00
Machines, general equipment, and tools, M & R	100,705 00	80,000 00	180,705 00
Ordnance equipment for aircraft, M & R	14,250 00		14,250 00
Photographic equipment and supplies, M & R	77,000 00	3,000 00	80,000 00
Radio equipment and supplies for aircraft, M & R	...	2,000 00	2,000 00
Hydrogen, maintenance, equipment, operation of plants for production of	82,800 00		82,000 00
Text books, books of reference, and publications, purchase of	59,424.00	5,000 00	64,424.00
Maintenance & Repair of equipment, material, and instruments for Air Service schools	64,000 00	5,000 00	69,000 00
Purchase of equipment, material and instruments for use at Air Service schools	407,000 00	25,000 00	432,000 00
Totals	$4,432,704 00	$ 471,500 00	$4,904,204.00

MAINTENANCE & OPERATION OF STATIONS

	Operation	Experimental Stations and Research	Totals
Building and grounds at Air Service stations, M & R.	$	$ 130,000 00	$ 130,000 00
Water		4,000 00	4,000 00
Light and power		38,000 00	38,000 00
Totals		$ 172,000 00	$ 172,000 00

HELIUM, EXPLORATION, CONSERVATION & PRODUCTION

	Operation	Experimental Stations and Research	Totals
Purchase of land for development of	$ 25,000 00		$ 25,000 00
Lease of land for development of	000,000 00		000,000 00
Construction, maintenance, equipment and operation of plants	817,750 00		817,750 00
Experimentation with and exploration for	32,500 00		32,500 00
Totals	$1,375,250 00		$1,375,250 00

EXPERIMENTAL AND RESEARCH, ENGINEERING AND DEVELOPMENT

	Operation	Experimental Stations and Research	Totals
Airplanes and accessories	$	$1,540,000 00	$1,540,000 00
Balloons, airships and accessories		1,259,000 00	1,259,000 00
Engines and accessories		538,000 00	538,000 00
Medical		18,000 00	18,000 00
Totals		$3,365,000 00	$3,365,000 00

PRODUCTION OF NEW AIRCRAFT, ENGINES AND ACCESSORIES

	Operation	Experimental Stations and Research	Totals
Special aviation clothing and similar equipment	$ 30,000 00	$	$ 30,000 00
Airplanes and their spare parts	17,784,655.00	2,900,000.00	20,684,655 00
Balloons and their spare parts	442,700 00		442,700.00
Airships and their spare parts	3,181,000.00		3,181,000.00
Engines and their spare parts		1,371,500 00	1,371,500 00
Instruments and accessories for aircraft and engines	250,000 00	50,000.00	300,000.00
Ordnance equipment for aircraft	60,000 00		60,000 00
Radio equipment and supplies for aircraft		30,000.00	30,000 00
Machines, general equipment and tools	560,000 00	40,000 00	000,000 00
Photographic equipment and supplies for use in connection with aerial observation	412,000.00	56,000 00	468,000 00
Totals	$22,720,355.00	$4,447,500.00	$27,167,855.00

IMPROVEMENTS OF STATIONS, HANGARS, SHOPS AND GAS PLANTS; LANDING FIELDS

	Operation	Experimental Stations and Research	Totals
Gas plants, hangars and repair shops, construction of	$9,048,000.00	$	$9,048,000.00

MISCELLANEOUS

	Operation	Experimental Stations and Research	Totals
Printing plants at Air Service stations, purchase of equipment and supplies for	$ 9,000 00	$ 23,000 00	$ 32,000 00
Printing plants at Air Service Stations, M. & R.		4,000 00	4,000 00
Printing and binding, Government Printing Office	60,700 00	15,000 00	75,700 00
Officers expenses while traveling by air	90,000 00	10,000 00	100,000 00
Officers mileage properly chargeable to Air Service appropriations	50,000 00		50,000 00
Damages, claims for not exceeding $250 00	10,000 00		10,000 00
Salvaging wrecked aircraft, supplies and services in connection with	25,260 00	8,000 00	33,260 00
Office equipment, purchase and repair of	77,660 00	20,000.00	97,660 00
Subscriptions to foreign and professional periodicals and newspapers	8,000 00		8,000.00
Miscellaneous services not properly chargeable to other items	75,000.00	50,000.00	125,000 00
Miscellaneous supplies and equipment not properly chargeable to other items	115,056 00	36,000 00	151,056.00
Officers tuition	13,750 00		13,750 00
Maneuvers, operations	100,000.00		100,000 00
Totals	$ 634,426 00	$ 166,000.00	$ 800,426 00

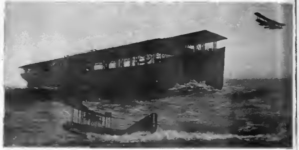
FUEL AND LUBRICANTS

	Operation	Experimental Stations and Research	Totals
Fuel and Lubricants	$ 3,507,059.00	$	$ 3,507,059 00
Grand Totals	$48,741,000.00	$11,259,000.00	$60,000,000.00

New Naval Fleet Development

Three new types of ships for the United States Navy that will round out the fleet and add tremendously to its effectiveness are now under construction

The first of these, the new battleships, authorized in the 1916 building program, will be the largest and most powerful battleships in the world Next come the fleet submarines, three of which are being built at the Navy Yard, Portsmouth These super-undersea craft will have sufficient speed and cruising radius to make it possible for them to accompany the fleet as a part of it.



THE U S S LANGLEY, AIRCRAFT CARRIER

The last of the trio is the latest type of aircraft carrier, the *Langley*. This vessel is the old collier *Jupiter*, refitted for her new role. Use of the *Langley* with the fleet will demonstrate the value of this type of vessel as she will be fitted with all the latest equipment for handling naval aircraft

The *Jupiter* is now at the Navy Yard, Norfolk, undergoing alterations to refit her as an aircraft carrier She has been renamed the *Langley* in honor of Professor Samuel Pierpont Langley, whose extended pioneer experiments on the problem of mechanical flight made his name widely known.

The *Langley* was also the pioneer ship of any Navy in the electrical propulsion field, her success establishing a precedent for future general ones in the economical propulsion of ships of all classes In refitting the *Langley* all of the coal handling gear has been removed and in its place will be erected a flying deck which will be located about 56 ft above the waterline, extending from bow to stern, a length of about 525 ft. and with a width amidships of about 65 ft This deck will be flush all over so as to make an ideal platform for flying off and landing Means will be provided on this deck for rigging an arresting device to facilitate landing Catapults for projecting the planes to give them the necessary speed for flight will also be provided on this deck forward and aft

An elevator will be installed for hoisting the planes from below to the flying deck and around this elevator, a palisade will be provided to form a wind break for protection to the planes while being assembled

Two cranes with large outreach, one on each side of the vessel, will be provided to hoist aircraft out of the water and land them on the hangar deck, which is the deck next below the flying deck. Beneath the flying deck, traveling cranes will be provided for hoisting planes out of the hold and for transferring them fore and aft to the shop spaces and elevator Shop facilities for repairing the planes will include machine shop, wing repairing shop, molding spaces, metal shop and various store rooms.

H. M. S. ARGUS, SEAPLANE CARRIER

The hold spaces are being refitted for the stowage of aircraft and their accessories, aircraft ammunition including bombs and torpedoes, ship's ammunition, fuel oil, gasoline and store room spaces. An elaborate system will be provided for distributing gasoline and lubricating oils to various stations on the hangar deck and flying deck.

LANDING DECK OF A BRITISH SEAPLANE CARRIER

The smoke pipe has been rearranged so as not to obstruct the flying deck and to keep the smoke clear of that deck, in order not to interfere with making a landing. This will be accomplished by providing a short smoke pipe on each side, clear of the deck. The branches will be interconnected so that the smoke can always be discharged on the lee side. One of the smoke pipes will be arranged to hinge downward when considered necessary to discharge the smoke near the water; the other is arranged to discharge the smoke downward through a water spray.

A radio outfit will be provided, carried on masts, which are capable of being completely housed below the flying deck. An auxiliary radio outfit has also been provided so that the planes can be communicated with when the main radio outfit is housed

The characteristics of the *Langley*, refitted as an aircraft carrier, are as follows:

Length between perpendiculars	520 ft.
Length overall	542 ft.
Beam	65 ft
Speed about	15 knots
Displacement, about	12,700 tons
Corresponding draft about	16 ft. 10½ in
Gasoline capacity	578 tons
Officers	45
Crew	260
Guns	4-5 in

Training for New Air Service Officers

Owing to the present shortage of commissioned personnel in the Army Air Service, and the consequent additional duties which devolve upon these officers, and due to the fact that about eighty per cent. of the present commissioned strength of the Air Service is newly commissioned, only a small percentage of the new officers can be sent as students to the Special Service Schools. As G. O. No 56, War Dept, requires all newly commissioned officers to be given the earliest possible opportunity to receive a basic military training, the difficulty must be partly overcome by assigning for instruction in flying as many of the newly commissioned officers as possible to pilot and advanced flying schools where they will also receive instruction in basic military subjects.

This basic training will also be given to newly commissioned officers at all other Air Service special service schools. As it is not feasible that officers who are not students at special service schools be required to attend regular classes from which they would obtain little or no knowledge of practical value, the immediate needs are to be met by some method of instruction other than a formal and perfunctory one, to be instituted in all commands, whereby officers may receive fundamental instruction so that they may not later be embarrassed or handicapped when called upon to perform military duties requiring the fundamental knowledge of various subjects.

Commanding officers of all Air Service activities have been directed to conduct such informal lectures and classes for newly commissioned officers as they may deem necessary, and such as will best accomplish the purposes desired. Air Service officers are also to be informed that they should have in their possession certain military publications for constant reference, also copies of the following, which they may obtain free of charge upon request through the proper military channels to corps area adjutants Army Regulations, Compilation of Orders, Indoor Drill Regulations, Army Courts-Martial, Non-Commissioned Officers' Manual, Field Service Regulations, War Department General Orders, Engineers' Field Manual, Rules of Land Warfare, and Small Arms Firing Regulations.

United Air Force-Pro and Con

One of the most important questions that will come before Congress during 1921 will be the much discussed United Air Force AVIATION AND AIRCRAFT JOURNAL *has favored the creation of such a force under a separate department, but desires its readers to know both sides of the argument In the following pages are presented first the opposition's reasons which reflect the position of many Naval officers, and second the reasons of many Army officers who favor a separate department.* —ED.

Some Arguments Against a United Air Service

The following are arguments which may be advanced against a United Air Service:

(a) Unity of command in war is an essential In military preparation for war those charged with responsibilities for efficiency in the Army and Navy must have *full cognizance of training.* The air is not a separate war area, but one common to both the Army and the Navy. The types of machines and numbers in the aviation services which are adjuncts to the Army and the Navy as well as the tactics of the Air Force must accord with the general military and naval policies. The above are impossible in a United Air Service.

(b) Naval aviation is a *part* of the fleet, and must exist as an integral part of the fleet. Naval aviators must be of the Navy, have Naval training, and be vitally interested in the work of the Navy, otherwise there must be loss of efficiency It is difficult to see how air stations like those at Hampton Roads and Pensacola, where these form a part of Naval stations, can be separate from the Navy

(c) The types of flying machines well-adapted for Naval purposes have not yet been produced. A tremendous amount of experimentation is necessary for their development and for the development of their tactical employment in connection with ships. In carrying on the development the designer must work closely and hand in hand with the operator and be familiar with the situation in which the operator is placed. Military aviation progressed much farther during the war than was the case with Naval aviation, and in types of machines and in the manner of their tactical employment the Army is much farther advanced than is the case with the Navy. The Naval problem is entirely different from the Army problem, and can only be solved by the Navy

(d) In time of peace, the production of many military machines is uneconomical for the government. Experimentation along logical and parallel lines by many is more desirable than by any single bureau or department Standardization means standing still Separate sources of supply make for competition, securing the best material. A single source of supply does not.

(e) Undesirable duplication will be avoided by a proper coordination of the activities of the Army and the Navy, and other departments of the government The various departments of the government must be given organizations which can deal directly with one another, insofar as aviation is concerned, and which can be held responsible for the avoidance of duplication between departments, and for a direct attack upon the difficult and numerous problems presented for solution.

(f) Normal life in the Army and the Navy in time of peace is exceedingly artificial. It is stimulated through esprit de corps and by competition. This competition, to some degree, may be unnatural, but it is nevertheless absolutely necessary if stagnation is to be avoided. Healthful competition between the Army and the Navy is desirable, insofar as aviation is concerned. Competition in the air is eliminated if a United Air Service is established

(g) By keeping aviation a part of the Army and the Navy and by retaining officers of the Army and the Navy in aviation, a mutual familiarity on the part of the Army and the Navy and their respective air services is assured. It can not be through other arrangements.

(h) Officers and men of a separate service can not be fed into the regular ranks of the Army and the Navy when they cease flying, as is the case at present, and these individuals would become pensioners upon the government at an early age.

(i) There is, to some degree, a natural and covert feeling of jealousy on the part of the line officers of the Army and the Navy against the aviator, and this jealousy is reciprocated to some degree by the aviator The regular line officer considers that the aviator should not draw extra pay and that he can fly but not think. The aviator considers that a man of the regular line is not particularly useful because he can not fly This breach, which can be controlled where aviation is a part of the Army and the Navy, would become wide indeed and very troublesome if the Air Service became an entirely separate organization.

(j) Officers, for personal reasons, wishing to attain high positions and pay, may also advocate this service, which, if established as has been outlined, would impose a terrific burden on the taxpayer by reason of the numbers and ranks proposed for the service and the pay active and retired thereby authorized.

The only good argument which may be made in favor of a United Air Service is based on the elimination of duplication, insofar as expenditures and materials are concerned This can be avoided by the determination on the part of the various governmental departments to prevent duplication.

There can be no doubt as to the advisability of having a centralized body of some kind in which all of the various departmental activities of the government are represented as well as those of civil aviation This organization should carefully scrutinize all the aviation projects on the part of the different departments of the government and point out anything which may cause duplication. Such a body would have cognizance of the licensing of pilots and machines, formulation of the laws for flying, and the fostering of civil aviation. It, in fact, would be the centralized body handling aviation in this country, and having cognizance of aviation in matters of international and interstate concern. The organization of such a body is undoubtedly necessary and should be effected at an early date, but its establishment should be in accordance with the needs of all departments of the government, as well as of civil aviation, and not in accordance with the desires of but a single element of one department of the government

On page 256 of "The Crisis of the Naval War" by Admiral Jellicoe, the following appears·

"In considering the future of the Navy it is impossible to ignore aircraft There are many important problems which the Navy and the Air Service ought to work out together A fleet without aircraft will be a fleet without eyes and aircraft will, moreover, be necessary, not only for reconnaissance work, but for gun-spotting, as well, as possibly, for submarine hunting Air power is regarded by many officers of wide practical experience as an essential complement to sea power, whatever future the airship and airplane may have for independent action

"A captain who is going to fight his ship successfully must have practised in time of peace with all the weapons he will employ in action, and he must have absolute control over all the elements constituting the fighting power of his ship. In a larger sense, the same may be said of an admiral in command of a fleet, divided control may mean disaster.

"The advent of aircraft has introduced now and, at present, only partially explored problems into naval warfare, and officers commanding naval forces will require frequent opportunities of studying them. They must be worked out with naval vessels and aircraft acting in close association. With the Air Service under separate control, financially as well as in an executive and administrative sense, is it certain that the Admiralty will be able to obtain machines and the personnel in the necessary numbers to carry out all the experimental and training work that is essential for efficiency in action? Is it also beyond doubt that unity of command at sea, which is essential to victory, will be preserved?

"In view of all the possibilities which the future holds now that the airship and airplane have arrived, it is well that there should be no doubt on such matters, for inefficiency might in conceivable circumstances spell defeat."

The Necessity of an Air Department

I. Tactical Necessity

From experience in this war, France and England became convinced that there had been certain changes in war strategy and war tactics that should be recognized, for, just as armies have found the necessity of establishing other branches in addition to infantry—for instance, field artillery and coast artillery, and, in a greater way, from the armed forces, it was found necessary to establish also sea forces—so the same principle applied to the Air Service. The keen and alert military minds of England and France became convinced that, from the pure standpoint of national strategy, a new force had been born, which, independent of either the land or sea forces, should be capable of operating in its own atmosphere. For these reasons, England and France established a Department of Aeronautics, and such a step is now necessary in this country in order that we may meet these countries on an equality.

It is now conceded by such eminent opposing authorities as Marshal Foch and General Ludendorff, that aviation is no longer an adjunct to the Army or to the Navy, that its main mission is no longer observation, with such missions as photographing enemy positions, adjusting fire for our artillery or finding the locations of our lines, but the main duty and mission of aviation is to fight, to clear the skies of the enemy's planes, and then attack troops on the ground or ships at sea by dropping bombs or inflammable matter, or even flying low and firing machine guns or light cannon.

It is obvious that this main duty is neither a naval nor a military mission. It is strictly aerial in every sense of the word, because it is immaterial to the aviation force as such whether the war is on land or on sea, since the method of attack to it is practically the same It would seem, therefore, that an air force should be established which could be used immediately according to the tactical necessity, which, of course would depend on whether the war was on land or on sea.

The one great thing that applies to aviation a thousand times more than to any other weapon of defense or offense is that distance is not measured by miles but by minutes. As the recent flight across the Atlantic showed that our shores can be bombarded on sixteen hours' notice, and the recent transcontinental test by our own Army shows that our continent can be crossed in twenty-four hours, it is certainly imperative that, if this force is to be properly developed, it must be under one centralized command so that it can be moved instantaneously upon notice of the emergency, without any reference to loss of time which will be caused by the red tape in getting the Army and Navy Departments together and the centralization of such planes as are distributed among the Treasury Department, the Post Office Department, and several other departments.

When we become involved in an aerial war, we must take no chances that are now necessary by the empty promises of coordination by those who hope to keep the Air Service under their own command and as an auxiliary to their own arm of the service, for the only way to coordinate properly is by having control, and the only way that this can be done is by establishing a Department of Aviation co-equal to the Army and Navy, and capable of acting with either of them, or independently of either

II. Avoids Duplication

There have been arguments advanced that the creation of a Department of Aeronautics will not increase the aerial efficiency of the United States, and that the only way in which aerial efficiency can be increased is by larger appropriations on the part of Congress. This argument is fallacious to the extreme Congress has been to liberal with aviation. They have not looked into the expense accounts of our Air Service. Our Congress has been repeatedly asked by the people to explain why England and France have wrested from the hands of America the supremacy of the air, when Congress has made such huge appropriations, on the face of which a complete aerial domination would be insured.

The truth of the matter is that England and France have centralized their activities under one command and have made one department responsible for their aerial defense and development, and, as a consequence, aviation in those countries has been developed by air officers, from a standpoint of national needs, and immediate and rapid utilization in case of threatened hostilities or war, while, in this country, aviation has been developed under artillery, infantry, and naval ordnance officers, post office railroad officials, and a variety of other officers who know absolutely nothing about aviation from an air standpoint. They have developed aviation sincerely enough for the good of their own particular service and as an adjunct thereto, without any reference to the national good and its total rapid utilization in case of emergency. As a consequence, the taxpayers' money has been used up by overhead expenses the salaries of five officials where one would be sufficient, and in a general duplication of effort everywhere.

At present, the Army and the Navy have stations on the same landing fields at Washington, D C, at Langley Field, Va., at San Diego, Cal., and at Ford Island, Hawaii. This is a useless duplication on the face of it, because they are doing precisely the same work yet they are two complete and separate organizations working absolutely independent of each other and without general reference to anything except the utilization as an adjunct to the Army or the Navy.

There are certain units which should be assigned to the Army and Navy permanently, and this could be done under the Department of Aeronautics. Then, in case of war, if it is land warfare, give the aviation to the Army, if it is sea warfare, give the air force to the Navy, if it is air warfare, give such part of the Army and the Navy may be necessary to the Air Force. Otherwise, as a matter of strategy, if we allow our aviation to be developed among these four or five different departments, working at cross purposes, in case of an aerial attack by a nation such as England or France, which has a Department of Aeronautics and a well trained force, any attempt to defend ourselves by the utilization of our widely separated aviation units would be just like a scrub football team, without any practice whatever in formation, in signals, trying to buck up against a well organized and trained "college eleven."

There is no need of having a large air force developed under the Army and another developed under the Navy, doing nothing but practice flying and the like, when the Post Office Department hires civilians to carry the mail by airplane, the Forestry Service wishes to hire airplanes to patrol its forests the Treasury Department wishes to patrol the borders by airplanes to keep out smuggling, the Bureau of Fisheries wishes to have airplanes patrol the coasts looking for schools of fish, the Coast and Geodetic Survey wishes airplanes to map the entire coast, the Geological Survey wants airplanes to photograph and accurately map the entire country, the Coast Guard wants airplanes to patrol the coasts and probably, in a short time there will be a variety of other departments demanding aviation for other work.

All these activities should be concentrated under one head, in which the air force should be paramount, and, when the air force is not immediately necessary for the defense of the country, it can be used for establishing aerial posts everywhere throughout the country, for mapping the country for the Geological Survey, mapping the coasts for the benefit of the Coast and Geodetic Survey, finding fish for the Bureau of Fisheries, patroling the coasts for the defense of the country, watching the borders to prevent smuggling for the Treasury Department, and any other duties that civil departments of the government may demand, for we must have a standing air force just as we have a standing Army and a standing Navy, and, as the main function of the Air Force is flying, this civil utilization of its efforts is exactly the training that it needs.

III. Commercial Aviation

The organization and equipment of an adequate Air Force is, at best, a most expensive undertaking. Other things being equal, that country will have the best aerial defense that utilizes her Air Force, in times of peace, to take care of the civil aviation requirements of the government as outlined in the preceding paragraph, and that nation will be best prepared to carry on an aerial war which has a large aeronautical industry built in peace times upon commercial output in order to take care of the war time demands.

An Air Force is like a standing army. It will never be large enough to care for the needs of the country in times of war or foreign hostilities. Therefore, a well developed peace time airplane industry is a great asset in the national defense of any nation. An airplane is an extremely technical weapon. It takes a long time to design it, and even to build the first one, and a much longer time to put it into quantity production. Under war pressure, it took this country sixteen months to put the first squadron of American built planes on the front. We can ill afford to wait sixteen months in the next war, but that is exactly the situation that will occur if we allow our airplane industry established during the war to become liquidated as it would seem will be the case by all present indications.

The nation will be best fitted to carry on aerial warfare that has a large commercial industry built and a large number of fliers engaged in commercial pursuits. With the industry operating on a peace time commercial basis, the production can be turned from commercial planes to military planes upon a moment's notice for an airplane is an airplane, no matter whether it is commercial or military, and the building of a commercial airplane requires the same material, the same skilled men, the same organization as does the building of a military plane The airplane industry is as necessary to adequate national defense as are navy yards and the ship-building industry. Airplanes must be converted into military planes the same as commercial ships into warships and transports.

England and France realize this, and, for this reason their governments, in addition to assisting in every way the development of commercial aeronautics at home, are even assisting the home aeronautical firms in exploiting fields of other nations. The aeronautical industry of England and France, with the assistance of their governments, has sent airplanes and fliers to China, Japan, Brazil, Argentina, and many other countries for the purpose of introducing their product. Not only have they done this but, they have also established five branch offices in the United States—that is, offices for five different firms.

These countries can afford to sell their products at less than the cost price in order to keep the industry at home, the idea being that, if they furnish the airplanes for the other countries, in case of war, the home country will have a big industry built which can be immediately turned into maximum war production on minimum notice, while the countries who have purchased their planes will be absolutely without an industry and with planes that may or may not be adapted to military use, and, even if adaptable, statistics have proven that the average life of an airplane in war is two months, while in peace it is eighteen months.

France and England have been lending every possible encouragement to the development of commercial aeronautics, and, to this end, France pays one-fourth the original price of every commercial plane bought by a French firm and pays 1000 francs a year toward the pay of the pilot who operates it.

Every pilot who flies a commercial plane successfully is 75 per cent toward efficiency as a military aviator. The other 25 per cent of his training could be in military formation, air fighting, and machine gunnery.

IV. *Unity of Command*

The one argument advanced against the creation of a Department of Aeronautics is by those high officials of the Army and the Navy who look upon aviation merely as an auxiliary or adjunct to their own arm or service. It is claimed that the creation of a separate Department of Aeronautics will take away from the naval or army commander one of his units, and therefore destroy unity of command. There are certain units which, from their nature, should be permanently attached to the Army and the Navy. These, for the most part, are strictly observation units.

It is not intended by the creation of a Department of Aeronautics to take away from the control and jurisdiction of the Army and the Navy those units which, from their nature, should be a part of them. However, the primary training being identical, the same for all classes of flying, it is proposed that this should be under the Air Force. When these units are sufficiently trained, they can be turned over to the Army or the Navy and permanently attached.

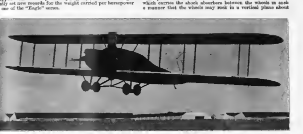
In addition to this, by the present legislation, the remainder of the Air Force, which comprises the pursuit, bombardment, and attack units, would be available for transfer to the Army or to the Navy, according to the tactical or strategical necessity. While so attached, if necessary, the entire Air Force would be under the control of the naval commander if, from the nature of the warfare, it was a "naval war."

The creation of a Department of Aeronautics would give absolute unity of command, but it would not allow the aeronautical efforts of the country to be subjected to the whims or caprice of half a dozen different commanders, working at cross purposes. In the recent war, when the Army was crying for planes and replacements, during the most active part of the fighting on the Western Front, the Navy had a small air force operating in connection with the British, and not doing any particularly vital work, whereas, if these forces had been concentrated, they could have been given to the Army at Chateau-Thierry, or any other battles in which some of the Army units lost seventy-five per cent in casualties among fliers, and could not get replacements.

The Curtiss Liberty Engined Eagle

The most recent development of the Curtiss Co. is a single engined airplane, capable of carrying ten persons, or three-quarters of a ton of freight for a non-stop flight of ten hours. Equipped with a 400 hp. Liberty engine, it has in test flights recently set new records for the weight carried per horsepower It is one of the "Eagle" series.

to the apex of a V brace extending from the bottom of the fuselage at the center. This construction allows a great deal of play of the individual wheels in taxi-ing over rough ground. Each pair of wheels is mounted at the ends of a short truss which carries the shock absorbers between the wheels in such a manner that the wheels may rock in a vertical plane about



The New Curtiss Eagle in Flight

This machine made a remarkable flight recently. Piloted by Lieut. Ross C Kirkpatrick with Max Goodnough as mechanic, the machine left the ground at 7·30 a. m. the morning of December 21 and landed at 1·36 a. m. the next morning This flight was under the control of the Army Air Service and was for scientific purposes. The only reason for coming down before it ran out of gas was a leak in the gas tank. It is expected that this machine will make another duration flight in the near future and it is hoped will break the world's duration record This is at present held by Bossoutrot and Bernard for a 25 hr flight in a Farman Goliath.

This flight merely demonstrates the general excellence of this latest Curtiss design and it is probable that the fullest advantage will be taken of its capabilities in the inevitable expansion of the American commercial aviation Its performance is certainly far ahead of many of the foreign contemporary designs.

The new machine flown by Bert Acosta has carried aloft a useful load of 3533 lb., or figured in units of horsepower, 9 lbs. per hp This indicates a distinctly good aerodynamical design, and makes possible very economical transportation of passengers and freight by air. The trials were witnessed by Brig Gen. William Mitchell, of the U. S. Air Service.

The Eagle has every appointment possessed by a high class limousine. Entrance is made through a side door reached by removable steps. The enclosed compartment is finished in leather, with ten individual upholstered seats arranged to permit free passage, dome lights, curtained triplex windows, which give protection from wind and noise, yet are arranged to give perfect vision. A luggage compartment is placed at the rear of the cabin.

The body is of monocoque plywood construction, combining lightness with strength and rigidity, and what is most important for a machine of this type, requires no transverse bracing, which would obstruct the cabin space.

The landing gear is a novel type composed of two sets of wheels arranged in tandem. The inner ends of the axles of both pairs meet at a point and are joined by a universal joint this point to accommodate any unevenness of the field. In landing with one wing low, two wheels are always in contact with the ground instead of a single wheel, as in the case of four wheels placed in a single line. This type of construction also possesses the advantage of low resistance, resulting from placing wheels in tandem with the shock absorbers between them. The usual elastic cord is used for shock absorbers.

The wing structure is particularly clean Streamline wires are used throughout The aileron controls run along the leading edge where inspection is always possible and resistance is small

The fuselage has a very good stream-line form, deepening rapidly after the engine into the cabin, and tapering gradually after the cabin to a fine tail. The horizontal stabilizer is adjustable in flight, as is required in machines of this type carrying a variable load.

Dual Deperdussin controls, placed side by side in the two front seats of the cabin, are arranged so as to give vision ahead and above through a window, and to the side by a large unclosed opening The control wheels are mounted on a single steel bridge with the motor controls between the seats, within easy reach of both the pilot and his assistant. Control leads are arranged to prevent fouling by either pilot or passengers. The gasoline tanks are carried beneath the floor of the cabin.

Specifications Curtiss Eagle with Liberty "400" Engine

Overall length	36 ft. 7½ in.
Overall height	12 ft. 11 in
Overall span	64 ft 4 in
Wing curve	U S A 15
Wing chord	83 in.
Weight, light	4245 lb
Weight, full load	7425 lb
Useful Load	
Gas	1500 lb
Oil	85 lb
Passengers and crew (10)	1600 lb
Loading	7.95 lb /sq ft
Loading	18 8 lb /h p
Low speed	51 4 m. p. h.
High speed	100 m. p h.
Service ceiling (full load)	10,000 ft.
Climb in 10 minutes	3236 ft.

Commercial Aviation in South America

The recent trip of inspection made in an airplane by L. H. Kisk, general manager of the Anglo-South American Bank, of the branches of that institution in Brazil and Uruguay has directed attention to the great progress in commercial aviation in South America. Mr. Kisk started in an airplane of the River Plate Aviation Company at Buenos Aires, the Argentine capital, and made the journey to Porto Alegre, Brazil, with necessary business stops at Montevideo, Rio Grande do Sul, Pelotha and Santa Anna, without a mishap and in a most comfortable manner. The actual flying time for the 625 miles was six hours and five minutes, as against an average of practically five days by rail and steamer transportation.

The South American countries have manifested a great interest in aviation ever since the world war Aircraft offered a solution of their perplexing problems of rapid transportation and communication between the different countries, and a means of reaching from the coast cities in the vast interior regions into which railroads have not been built. These interior regions with their rich natural resources had, as a general thing, no other means of communication with the outside world except the slow transportation furnished by the rivers and the highways. A mail and limited freight service by airplane has been carried on between the Pacific coast and towns in the Andes by which the time consumed in necessary travel has been reduced from four and five days to as many hours. The upper La Plata region and the valleys of the Uruguay and the Parana have been served by airplanes in six hours where formerly a week was required to cover the distance.

The British airmen early saw in South America an inviting and profitable field. They directed their attention especially to Brazil and made Sao Paulo, where a national school of aviation was to be established, the central point of their efforts. Americans, however, seemed to have succeeded in arousing a more permanent interest, for when the school was opened a large number of American air machines were purchased, and two American aviators, Lieutenant P. A. Cusacks and Lieutenant O. B. James, were chosen as instructors. Americans too have had service in other countries, several were instructors in Chile and assisted in laying out the transandean routes, and Lieutenant Donald Hudson who flew over Mount Illimani and passed over the city of La Paz at the record height of 18,000 feet, planned the air routes of Bolivia. A commercial airplane service was established recently at Lima, Peru, and Walter Peck, an American aviator, piloted the first machine with an American representing a New York cotton firm as the first passenger The distance from Lima to Pasco, 130 miles, was made in two hours, formerly the trip was made in two days by a small steamer sailing every ten days.

International Aircraft Marking

By Ladislas d'Orcy

The reconvening of Congress again brings to the fore the serious question of the international aerial convention which United States Ambassador Wallace signed on May 31, last, in Paris, with certain reservations.

Before this convention can bind the United States to the other contracting states—twenty six in number, including our neighbors, Canada and Cuba—it must be ratified by Congress. After which, if the convention is not to remain a dead letter, there will be required an Act of Congress creating the necessary federal machinery which alone can provide for a nation-wide enforcement of said convention.

That it is highly desirable for the United States to become a party to the Paris convention has been set forth in these columns before. The only unfortunate point about the convention is that the International Commission for Air Navigation which it institutes is placed under the control of the League of Nations. This feature may defeat all attempts tending toward its ratification by Congress. If it does, then the next best thing Congress can be expected to do is to enact a national air legislation which would be based on the text of the Paris convention except for such provisions of the latter as were reserved by Ambassador Wallace and for its connection with the League of Nations.

Such national air legislation should reproduce the agreed provisions of the Paris convention as closely as possible, for it is of the utmost importance for American aeronautics that a single set of regulations apply to air navigation throughout the United States as well as in Canada, Mexico and Cuba. Our next door neighbors naturally afford us the readiest field for aerial intercourse. American mail and passenger air lines are already operating from the extreme tips of this country to Canadian and Cuban ports, and only the other day two airplanes flew without much ado from Lincoln, Neb., to Mexico City.

These are but small beginnings. Larger enterprises have so so far failed to materialize mainly because of the legal insecurity American aircraft have suffered from, owing to the absence of competent national air legislation. Once the latter exists it cannot be doubted that American aeronautics will derive the same benefits from a single national air code as has been the case with the countries that possess such an instrument of control.

Nationality and Registration Marks for Aircraft

The demand for a national air code incidentally brings up the question of the nationality and registration marks for aircraft. Such marks must be capable of prompt identification from the ground when aircraft are in flight, so that trespassers of the aerial law may be quickly apprehended. The experts who framed the Paris convention very carefully considered this point and agreed that the nationality and registration marks should entirely consist of letters, rather than of letters and numerals. Annex A of the convention contains the following provisions in regard to the marking of aircraft:

The nationality mark shall be represented by a single letter, while the registration mark shall be represented by a group of four letters, each group containing at least one vowel. For this purpose the letter Y shall be considered as a vowel. The complete group of five letters shall be used as a call sign of the particular aircraft in making or receiving signals by wireless telegraphy.

Flying machines—that is, airplanes, seaplanes and flying boats—shall be marked in the following manner:

The nationality and registration marks, divided by a hyphen, shall be painted in black on a white ground on (1) the upper surface of the top main plane, (2) the lower surface of the bottom main plane, and (3) the right and left sides of the fuselage or of the hull, between the main planes and the tail planes.

The nationality mark *alone* shall be painted as above specified on (1) the right and left sides of the rudder, or on the outer sides of the outer rudders if more than one is fitted and (2) the right and left sides of the upper and lower surfaces of the horizontal stabilizer or of the elevator, whichever is the larger.

The height of the marks on the main planes and tail planes shall be equal to four-fifths of the chord, and in case of the rudder shall be as large as possible. The width of the letters shall be two-thirds of their height and the thickness, one-sixth of their height. The letters shall be painted as plain block letters.

Fig 1 illustrates a Canadian seaplane marked in accordance with these provisions, except that no mark appears on the upper surface of the top plane. Figs. 2 and 3 show two very poorly marked machines of French and Italian nationality, respectively. On the F-FRAB the marks are painted directly on the machine instead of being displayed on a white background; as a result they are faint in outline. At an altitude of say 1,000 feet these marks would hardly be visible from the ground, whereas those of the Canadian seaplane would still show up clearly. Furthermore, the nationality mark on the rudder is placed too low to be easily spotted. The marking of third machine, the I-ANTE, is even worse. The letters painted on the fuselage are far below the size provided for in the convention and the rudder mark is totally missing.

The main object of this criticism is to show how important it is to carry out the provisions of a regulation correctly if the latter is to be of any utility at all. The rapid rate of travel of aircraft makes such compliance particularly imperative.

An Appeal to Imagination

But the visible display of aircraft marks is not the only requirement desirable from the viewpoint of prompt identification. An aircraft mark may be visible enough, but if the nationality letter does not easily convey the name of the country it stands for, its utility will be greatly curtailed. The problem is complicated by the fact that while there are but twenty-six letters in the alphabet, the sovereign states of the world number about sixty. It follows that some countries have to be designated by two letters.

The system adopted in the convention follows this principle by assigning to the great powers, which are the world's principal aircraft users, a single letter to denote their nationality, while all the other contracting states are designated by two letters. In the case of the latter, therefore, the registration mark (group of four letters) always begins with a given letter, fixed by the convention.

It would be interesting to know what criterion served in the selection of some of the letters the convention provides for in this connection. While "G" stands for Great Britain, "F" for France, "I" for Italy, and "J" for Japan, which seems logical, the United States is designated by the letter "N". Why "N" should be the nationality sign of this country is a mystery which nobody has yet tried to explain. Surely, this is not a characteristic letter for designating the United States, the more so as no other country is given the letters "U" or "A".

The method followed in assigning the two-letter nationality marks is even more surprising. It might have been expected that where the names of two or more countries begin with the same letter, this would be retained as the common initial, while the second letter would be specially selected with a view to distinguishing the names from one another.

For instance, "B-E" would stand for Belgium, "B-O" for Bolivia, "B-R" for Brazil, and so forth. Instead the Convention assigns to such countries the second letter in common, while the first is chosen arbitrarily. Actually "O-B" stands for Belgium, "C-B" for Bolivia, and "P-B" for Brazil, which comes to say that on the tailplanes of an airplane the letter "O"

Fig. 1

Fig. 2

Fig. 3

indicates Belgium, while "P" indicates Brazil. As there will eventually be some fifty two-letter nationality marks for aircraft, the difficulty of remembering such fanciful letters will be appreciated. It should further be noted that the first letters of the two-letter nationality marks provided for in the convention do not serve as an unmistakable distinguishing sign for a given country, for while "S-G" stands for Greece, "S-P" indicates Panama.

It will be apparent from the foregoing that the table of nationality marks given in Annex A of the convention is a sort of cabalistic script, which, instead of simplifying the problem, merely complicates it. It is therefore suggested that if Congress ratifies the convention and American delegates are appointed to the International Commission for Air Navigation, an attempt be made by our representatives to bring about a revision of the nationality marks in a manner that would more appeal to imagination and hence be more practical than the existing marks.

A tentative table of revised nationality marks is submitted herewith -

Proposed Table of Nationality Marks for Aircraft

NOTE. The nationality marks provided for in the Convention for the Regulation of Air Navigation (Annex A) are bracketed after the names of the contracting states.

A

A-B Abyssinia
A-F Afghanistan
A-L Albania.
A-M Armenia.
A-R Argentine Republic.
A-Z Azerbaidjan

B

B-E Belgium. (O-B)
B-O Bolivia. (C-B).
B-R Brazil. (P-B)
B-U Bulgaria.

C

C-H Chile.
C-O Colombia.
C-R Costa Rica
C-U Cuba. (C-C).
C-Z Czecho-Slovakia. (L-B)

D

D Germany

E

E-C Ecuador (E-E)
E-S Spain.
E-T Esthonia.

F

F France

G

G Great Britain. (G).

H

H-D Honduras. (X-H).
H-I Haiti. (H H)
H-L Greece. (S-G)
H-V Switzerland
H-Z Hedjaz. (A H)

I

I Italy (I)

J

J Japan (J)

K

K-N Netherlands

L

L-A Latvia.
L-B Liberia. (L-L)
L-I Lithuania.
L-X Luxemburg

M

M-A Hungary
M-X Mexico

N

N-I Nicaragua. (A-N)
N-O Norway.
O-E Austria

P

P-L Poland. (P-P)
P-N Panama. (S-P)
P-R Portugal. (C-P)
P-S Persia.
P-U Peru. (O-P)
P-Y Paraguay.
Q China

R

B Russia

S

S-D Santo Domingo
S-M Siam. (H-S)
S-S San Salvador.
S-V Sweden

T

T-U Turkey.

U

U United States. (N)

V

V-Z Venezuela

X

X-D Denmark.
X-F Finland.
X-G Guatemala. (L-G)
X-I Iceland
X-R Roumania. (C-R).
X-U Uruguay (C-U)

Y

Y-S Yugo-Slavia. (X-S)

Z

Z Palestine.

The following principles served for the elaboration of this table. Whenever possible, the nationality mark was so formed as to characterize most strongly the country in question, whether it be designated by one or two letters In this connection attention was paid to the name each country is called in the national language. For this reason "U" is suggested for the United States, "D" for Germany (*Deutschland*), "E" for Spain (*Espana*), "H-L" for Greece (*Hellas*), "H-V" for Switzerland (*Helvetia*), "K-N" for Netherlands (*Koningrijk der Nederlanden*), "M-A" for Hungary (*Magyárorszag*), and "O-E" for Austria (*Oesterreich*) No attempt is made to justify the use of "Q" for China, except expediency

Great difficulty was experienced in forming the nationality marks of countries whose names begin with a letter fully assigned to one of the great powers. Thus Denmark clashed with Germany, Finland with France, Guatemala with Great Britain, Iceland, now a sovereign state, with Italy, Roumania with Russia, and Uruguay with the United States. Two alternative solutions are suggested for this problem. The first consists in adopting the letter "X" as a common nationality mark for the clashing names of such countries and their true initial as the second letter, that is, "X-D", "X-F", "X-G", etc. This is shown in the above table.

The second method suggested would designate the great powers and the clashing countries with common initials, but would reserve in the four-letter group the letter "X" for the use of the smaller states To illustrate.- "U-A" to "U-W" and "U-Y" to "U-Z" would stand for the United States, while "U-X" would designate Uruguay In both methods the letter "X" is selected because it is easily distinguishable from all others. Perhaps Uruguay could be designated by "O-U", since the full name of that country in Spanish is *Republica Oriental del Uruguay.*

It is realized that the national marks suggested above, particularly those using the letter "X", do not entirely overcome the criticisms formulated in regard to the table provided for in the convention Perhaps additional study of the question may lead to an improved system However that be, it is strongly felt that the international aircraft marks as they now stand should be revised before such a decision will cause inconvenience to the parties concerned.

No nationality marks are suggested for the smallest states of Europe, Andorra, Monaco, San Marino, Fiume, Liechtenstein and Danzig, as it is believed that aircraft from these states will assume registry in the contiguous countries with which their activities are closely connected.

Aviator's Certificates

The following excerpts from the Rules and Regulations of the International Aeronautic Federation governing the issuing of pilot's certificates will be interesting:

1 Candidates must accomplish the three following tests, each being a separate flight

A and *B* —Two distance flights consisting of at least 16,404 ft. each in a closed circuit, without touching the ground or the water, the distance to be measured as described in Article 4 below.

C —One altitude flight, during which a height of at least 3,280 ft above the point of departure must be attained: the descent to be made from that height with the motor cut off. A barograph must be carried on the airplane in the altitude flight. The landing must be made in sight of the observers, and without restarting the motor.

2. The candidate must be alone in the aircraft during the three tests.

3 Starting from and landing on the water is permitted in only one of tests *A* and *B*.

4. The course on which the aviator accomplishes tests *A* and *B* must be marked out by two posts or two buoys situated not more than 547 yds. apart.

5 The turns around the posts or the buoys must be alternately to the right and to the left, so that the flight will consist of an uninterrupted series of figures of 8

6. The distance flown shall be reckoned as if in a straight line between the posts or the buoys

7 The landing after the two distance flights in tests *A* and *B* shall be made as follows

(*a*) By stopping the motor at or before the moment of touching the ground or the water.

(*b*) By bringing the aircraft to rest not more than 164 ft. from a point which has previously been indicated by the candidate.

8 All landings must be made in a normal manner, and the observers must report any irregularities.

Official observers must be chosen from a list drawn up by the governing organization of each country.

The issuance of the certificate is always optional.

Solar Radiation and Balloons

By Junius David Edwards* and Maurice Blaine Long†

Sunlight has an important effect upon the life and operating characteristics of lighter-than-air craft. It affects both the temperature and life of the fabric of which the balloon envelope is constructed and the resulting temperature changes affect both the operation of the balloon and its gas permeability. These factors have long been known and more or less empirical attempts made to control them Progress would be more rapid along these lines, however, if there were quantitative data available as to the character and magnitude of these effects. To supply this need an investigation of certain phases of the problem was carried out at the Bureau of Standards. This paper describes some of the methods and results of this investigation, for a more detailed report, the reader is referred to Technologic Paper 128 of the Bureau of Standards.

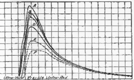


FIG. 1

Sunlight affects the operation of the balloon because changes in its character and amount cause fluctuations in the temperature of the balloon envelope and consequently in the temperature and lifting power of the gas contained in it. The radiation characteristics will be discussed first, therefore, from the standpoint of their effect upon temperature rise.

The other effect of the sunlight, that of its photo-chemical action upon the fabric, results in decreasing the strength of the fabric and causing deterioration of the rubber. This eventually results in increasing the porosity of the fabric to an inadmissable extent.

Solar Radiation

Before discussing its relation to aeronautics a short summary of the characteristics of solar radiation, which are essential to an understanding of the problem, is included for the reader's convenience The intensity of the radiant energy from the sun varies in different parts of the spectrum. Curve *A* in Fig. I shows graphically the general distribution of energy in the solar spectrum before entering the earth's atmosphere. Inside of the earth's atmosphere both the total intensity and the relative spectral distribution are changed owing to diffuse reflection and absorption by the atmospheric gases, water vapor, and dust particles.

The general energy distribution as observed on Mount Whitney (altitude 4420 m.) is shown by curve *B*, on Mount Wilson (altitude 1730 m.) by curve *C*, and at Washington, D C., by curve *D* It is worth noting here that the shorter wave lengths are absorbed most by the passage through the atmosphere, and the longer wave lengths are absorbed least. The curves drawn in solid lines in Fig 1 are for the sun at the zenith. With the sun at any other point than the zenith, the air path through which the radiation must travel is increased and the radiation suffers a further loss of intensity. Curves *E* and *F* show the relative intensity at Washington when the sun is at angles of 60 deg and 70 deg, respectively, from the zenith.

These curves refer only to the relative intensity of the solar radiation, but in order to correlate the temperature of a body with the radiation falling on it, it is necessary to know in absolute measure the intensity of the radiation. The evidence from investigation indicates that the solar constant, C_o, as this rate is called, is subject to periodic variations of about 7 percent, but when the earth is at mean solar distance the average value is:

$$\begin{aligned} C_o &= 1.93 \text{ g. cal. per cm}^2 \text{ per min.} \\ &= 3.22 \times 10^{-2} \text{ g-cal. per cm}^2 \text{ per sec.} \\ &= 1.34 \times 10^{-1} \text{ watts per cm}^2 \end{aligned}$$

The following values have been observed under favorable conditions at the points named:

Estimated for an atmosphere	$C_o = 1.93$
Mount Whitney (4420m.)	$C = 1.78$
Mount Wilson (1730m.)	$= 1.64$
Washington	$= 1.35$

These values are not maximum values, but are representative of clear, dry, summer days. A value of 1.51 has been observed at Washington

It is evident that for any given time the value of C at different altitudes could be represented by a curve. Such a curve is shown in the first part of Fig 2. Two curves are shown, one gives the values at noon, the other at approximately 8 a. m or 4 p. m. Both curves are computed for a July day with sky cloudless, of average clearness and with an average amount of water vapor and dust present. At earlier or later hours than 8 a. m. and 4 p. m., respectively, the intensity decreases very rapidly, between those hours the solar intensity for any given altitude will be found between the two curves Accordingly the solar intensity will usually either be within the limits set by the two curves or be negligible.

Atmospheric Conditions

The effect of air pressure temperature, and wind velocity upon the temperature rise and operation of balloons makes it also important to have a knowledge of the variation of these factors with change in altitude. There are, of course, certain day-to-day and seasonal variations in these conditions. The values shown in Fig 2 represent average conditions in latitudes 35 deg to 40 deg It will be noted that the average temperature gradient for summer and winter is approximately the same

Radiation Characteristic of Fabrics

The observed effects of sunlight on a balloon must be due in part to the radiation properties of the fabric forming its envelope The fabric, therefore, bears a direct relation to the operating characteristics of the balloon. It will be advisable, however, to discuss first the radiation properties of balloon fabrics quite apart from their intended use.

When radiant energy is incident upon any surface a fraction of all wave lengths is reflected, a fraction of most wave lengths is absorbed and a fraction of some wave lengths may be transmitted It is obvious that only the absorbed energy can affect the fabric, causing either a chemical or a physical change, for the remainder is either reflected or transmitted unchanged. It is, then, this absorbed energy, and the absorbing property of the fabric in which we are interested.

The absorbed radiant energy appears in the fabric principally in the form of heat energy The direct measurement of the fraction of radiation absorbed is not possible, but since all radiation not absorbed must leave one surface or the other it may be considered as either reflected or transmitted,

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and if these parts can be measured in terms of the incident radiation, then the fraction absorbed can be found. For example, if a fraction R of the incident radiant energy is reflected, a fraction F is transmitted, and a fraction A is absorbed, the following relation is obvious

$$R + F + A = 1$$
or
$$A = 1 - (R + F)$$

Thus the absorption is given in terms of the transmission and reflection and the quantity A times the incident energy represents the rate at which heat will be generated in the fabric. A fraction of this heat will be lost by conduction and convection, while another portion will be reradiated. The portion reradiated depends upon a radiation property of the surface, called the emissivity. The magnitudes and interrelations of these factors determine the temperture rise of the fabric.

The general method for determining the reflecting power of any surface is to measure the energy (radiant power) of a beam of light before and after reflection from the surface. The ratio of these values gives the reflecting power for the light used as a source. The apparatus used for making these measurements was devised by Dr W. W. Coblentz, of this Bureau, and we are indebted to him for the loan of the original apparatus and his assistance in making the preliminary measurements. The method in brief was to measure the energy of a uniform beam of light by means of a linear thermopile. The energy of the same beam was then measured after reflection at normal incidence from a sample of the fabric under test. The transmission was determined with the same apparatus with some modifications, the method was to measure the energy of the beam of sunlight before and after passage through the fabric.

Because of the difficulty of using a moving body, such as the sun, as a source of radiation for measurements where of necessity an interval of time existed between the measurements of incident and reflected light, solar radiation was used in only a few of the measurements. A fair substitute for the sun was found by using the radiation from a nitrogen-filled tungsten lamp transmitted by a 2-percent solution of cupric chloride, 2.5 cm. in thickness.

While the spectral distribution of energy in the radiation from the lamp after passage through cupric chloride solution is somewhat similar to that of sunlight, yet it is not as rich in the shorter wave lengths. The solar radiation reaching the earth's surface, as shown in Fig 1, has a maximum intensity at about 0.5μ, while that of the radiation used in the reflection and transmission measurements has a maximum near 0.6μ.

It was noticed that without exception, where measurements were made, the reflecting power for sunlight was somewhat less than for the light used. This was also true for the transmitting power. However, the relative reflection and transmission remain about the same for each of the sources and the measurements give a reliable comparison of the different fabrics. Table No 1 shows the results.

Temperature of Balloons

The temperature and the corresponding lifting power of the gas are determined, solely by the temperature of the fabric, for the absorption of radiation by the gas is negligible.

The temperature of a thin sheet of balloon fabric upon which radiation is falling, is dependent on (1) the intensity of the radiation, (2) the absorbing power of the surface for the incident radiation, (3) the emissivity of the surface at the temperature in question; (4) the loss of heat by conduction and convection, both from the front and back surfaces. An elementary mathematical analysis of these factors is given in T P 128 but will not be attempted here.

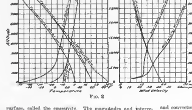

FIG. 2

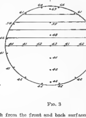

FIG. 3

It was decided to make a preliminary survey of the problem by means of measurements on a small-sized model balloon. These measurements were designed to show the temperature of the surface of the balloon at different points and the temperature gradient in the gas contained in the envelope.

The model balloon which was used for the measurements of the temperatures of the fabric and gas was a model of a stream-line dirigible and had a maximum diameter of 3 feet and a length of 12 feet. The measurements of temperature were made by means of copper-constantan thermocouples and a potentiometer. The couples were made by soldering the elements in the form of No. 36 B & S gage wire, to very thin, bright metal receivers, 1.5 mm by 3.0 mm. Some of these receivers were in turn cemented to the inner surface of the balloon by means of Canada balsam. In this way an excellent contact was made between the thermocouple and the fabric and yet the receiver was not so massive as to affect the temperature measurements. Similar thermocouples of the same size were supported at various points inside the balloon by means of the No 36 wire leads. These could be drawn from one side of the balloon to the other, thus exploring the temperature of the gas throughout a circular cross section of the balloon.

In order to determine the relative rise in temperature of different fabrics, square samples 7 cm. on a side were supported in a position for normal solar incidence with a thermocouple, as described above, mounted on the lower surface. Two fabrics were exposed at the same time, one being used as a standard and all others compared with this one.

In order to place results obtained at different times and under different conditions of solar radiation and air temperature on a comparable basis, we have assumed a standard condition where the air temperature is 25 deg. C and the solar intensity equals 1.4 g calories per square centimeter per minute.

The temperature of the surface of the balloon and of the contained gas at various points is shown in Fig 3. In this figure the locations of the thermocouples attached to the fabric and inside the balloon are shown by black dots and the temeprature in degrees Centigrade at each point is indicated by the figures.

TABLE 1.—RADIATION CHARACTERISTICS OF BALLOON FABRICS AND THEIR INCREASE IN TEMPERATURE WHEN EXPOSED TO SUNLIGHT

(Except where stated otherwise all fabrics are of two-ply construction with an outer surface or coating of the character indicated.)

No.	Description of fabric	Sample of fabric	Radiation from Tungsten lamp after passage through 2.0 percent solution of Cupric chloride: Reflection	Transmission	Absorption	Radiation from sun solar intensity, 1.4 g-cal. per cm² per min. Temperature rise above air temperature of 25° C
			Percent	Percent	Percent	°C
1	Airship fabric after 80 days' exposure, aluminum coated		54.0	0.0	45.0	22.1
2	Airship fabric, aluminum coated		50.7	0.0	49.3	
3	Experimental airship fabric, aluminum coated		40.0	0.0	60.1	22.0
4	Fabric same as No 1 before exposure		44.0	0.0	56.1	28.0
5	Experimental airship fabric aluminum coated		40.1	0.0	59.9	24.5
6	Aluminum coated fabric covered with nitrocellulose "dope"		52.4	1.4	46.2	
7	Aluminum coated fabric dusted with talc		22.6	0.1	77.3	
8	Ballonet fabric uncoated cloth surface		42.2	11.0	46.8	19.8
9	Experimental single-ply fabric, pure gum coating		39.2	12.4	48.4	
10	French airship fabric cloth surface dyed chrome yellow (1918)		41.0	3.1	55.0	20.7
11	Kite fabric 30 days exposure light brown rubber coat		26.1	2.6	71.3	25.0
12	Kite fabric 30 days exposure light gray rubber coating		19.8	2.6	77.6	23.0
13	Kite fabric No 11 before exposure		19.4	2.4	78.2	30.0
14	Fabric from model balloon used in this investigation		16.9	4.1	80.0	(40.4)
15	Kite fabric 30 days exposure, olive green rubber coating		12.1	0.6	87.3	32.4
16	Experimental fabric, cloth surface dyed olive drab		6.5	2.8	90.7	34.1
17	Experimental fabric dark gray rubber coating		8.3	0.0	91.7	38.0
18	Experimental single-ply fabric black rubber coating		5.7	0.2	94.1	37.4
19	Experimental fabric, dark green rubber coating		5.2	0.0	94.8	36.0

A significant fact to be noted in these figures is that the minimum temperature occurs just below the beginning of the shadow on each side of the balloon. This condition was found in every series of measurements made, and it can not be considered, therefore, unusual. The higher temperature at the lower surface is probably due to a greater intensity of transmitted sunlight at that point. The highest temperature measured on this model balloon was 66.4 deg C (152 deg F) with a surrounding air temperature of 25.5 deg C (78 deg F) and a solar radiation intensity of about 1.42 g calories per square centimeter per minute.

It should be noted that a differences in temperature of as much as 25 deg C may exist in different parts of the gas. It is therefore important, in reporting such measurements to specify the location of the point at which the measurement is made. The presence of the balloonets in the full-size envelope would probably tend to accentuate the difference in temperature between the upper and lower surfaces. The ballonet acting as a sort of diaphragm across the interior of the balloon would absorb the transmitted and reradiated energy from the upper surface and heat the upper surface by reradiation just as did the lower surface in the model balloon. The lower surface would consequently be relatively cooler than in the case of the model balloon.

It is worth while, also, to note the rapidity with which the temperature changes at different points in a balloon when passing from direct sunlight into the shadow of a cloud, and vice versa. For this purpose measurements of the temperature of the upper and lower surfaces and the temperature of the gas at the center and half way between the center and upper surface, were made as nearly simultaneously as possible. These measurements were made on the model balloon at a time when small dense clouds were visible. The results are shown graphically in Fig 4. The ordinates represent the true observed temperature and the abscissas the time interval in minutes. The curves A, B, C, and D represent, respectively, the temperature of the upper surface of the gas midway between the center and the top, of the gas at the center, and the temperature of the lower surface. With rapidly changing temperature the temperature of the gas at the center is seen to be almost wholly dependent on that of the lower surface and to lag behind it from 1 to 2 minutes.

During the time interval (a—b) of 3 minutes the temperature changes were as follows:

	C deg.
Upper surface	20.6
Upper gas	10.0
Center gas	1.5
Lower surface	5.8

If the "upper" gas temperature represents an average for the upper half of the balloon and a mean of the center gas and lower surface temperatures an average for the lower half, then the average temperature change of the gas is 8.4 deg. C. The initial temperature was 43 deg C or 316 deg absolute, therefore, the volume diminished 2.7 per cent (8.4/316) in 3 minutes, the pressure remaining constant. This means a volume, or buoyancy, change of 0.9 per cent per minute. To show the effect of such a rapid change it may be supposed, though not probable, that the average temperature of the gas in an airship of 200,000 cubic feet capacity suffers such a change. In such a case it would be necessary to fill the ballonet at the rate of 1800 cubic feet per minute to keep the envelope properly inflated. It would be interesting to observe the actual magnitude of these changes in practice.

The rise in temperature must be measured for all fabrics under indentical conditions, if a fair comparison is to be secured. It was found that the increase in temperature above that of the surrounding air was directly proportional to the solar intensity over a rather wide range. It was therefore possible to make the temperature measurements for various solar intensities and extrapolate for a standard solar intensity, which was taken at 1.4 g. calories per square centimeter per minute. All results are given for still air surrounding the fabric at a temperature of 25 deg. C, which is the temperature at which permeability measurements of these fabrics are made in this laboratory. The rise in temperature for a number of fabrics, when measured in this manner is shown in the last column of Table 1.

Selection of Fabric

There are as many qualities which may be desirable in a balloon fabric and the requirements for each may be so conflicting that the resultant choice must be a compromise. The choice will, however, take into consideration the specific use

for which the fabric is intended. The considerations of strength and elastic properties are more or less independent of the other properties of the fabric. Weight, radiation characteristics, color, visibility, and durability are, however, all interrelated and must be considered together.

It has been pointed out that from the standpoint of the

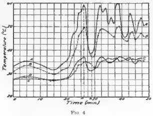

Fig 4

effect of radiation in raising the temperature, a nearly transparent fabric or a perfectly reflecting surface would be most desirable. Such a fabric is not a possibility at the present time, however. A fabric with a white rubber coating compounded with zinc oxide would also be favorable from this standpoint, although not from others. Fabrics Nos. 8 and 9 in Table 1, which have the color of the unbleached cloth and the pale yellow of pure vulcanized rubber, show a very small increase in temperature, but because they lack any protection against the injurious action of light their useful life would be very short. This objection, however, does not apply to the aluminum-coated fabrics. The aluminum coating not only protects the gas-retaining rubber film by virtue of its opacity to light, but also, because of its high reflecting power, remains comparatively cool when exposed to sunlight. The deterioration of fabrics 8 and 9 when exposed to the weather in summer at Washington is about ten times as rapid as in the case of the best aluminum-coated fabrics.

For military purposes where low visibility is desirable, there are sometimes objections to the use of the bright and highly reflecting aluminum coat. Also the weight of the aluminum coating may be undesirable for envelopes where a very light fabric is required. In these cases it is necessary to use a dyed or pigmented rubber-coated fabric which meets the color and visibility requirements and yet shows a minimum temperature effect and satisfactory durability characteristics.

It has been possible only to outline in these few paragraphs the many considerations which affect the choice of a balloon fabric. The effect of radiation upon the fabric should not be lost sight of in any case, even if it is not of most importance, frequently an improvement of the fabric in this respect can be obtained without the sacrifice of any other desirable characteristics.

Standard Charges for Airport Service

The following tables are reproduced from the French journal *L'Air* and show the standard charges for the various services at licensed airports. It will be recalled that the terms of the International Air Convention require that this schedule be uniform in any country and that no distinction be made between foreign and national aircraft. Another regulation provides that the schedule be posted in a conspicuous place at the airport.

Landing Charges

	France A	France B	France C	Belgium A	Belgium B	Belgium C
Subscribers Aircraft, (in the common shelter with the right to personnel)	3 00	4.60	6.00	3.00	4.60	6 00
Aircraft of permanent firms (no right to personnel)	3 00	4 00	6.00	3.00	4.60	6 00
Transient Aircraft (right to personnel)	15 00	23 00	30.00	12.00	18.40	24 00

	England A	England B	England C
Rate for holders of books of tickets	5.00	10 00	20 00
Ordinary rate	6 20	12 50	25 00

Garage Charges (24 Hours)

	France A	France B	France C	Belgium A	Belgium B	Belgium C
Transient Aircraft (right to personnel).	20.52	58.80	57 75	13 68	39 20	38 50
Subscriber's Aircraft.	8 20	23.52	23 10	8 20	23.50	23 10
Permanent Firms:	This is on the basis of a minimum contract for three months at the rate of 1 fr per square meter per month. No right to personnel and lighting etc. charges paid by lesse.					

	England A	England B	England C
Transient Aircraft	12 50	25 00	00 00
Daily Aircraft	8.30	161 60	33 20

In France and Belgium Class A contains machines of approximately the same size as the Breguet; Class B, Farman Goliath and Class C, Caproni. In England, Class A contains machines with less than 83 sq.m. of wing surface; Class B, less than 166 sq.m., and Class D, more than 166 sq.m.

Transport Charges

	Capacity	Rate per kilo France	Rate per kilo Belgium
Class of Vehicle Trucks	2,000 to 3,000 kg.	2.75	2.00
	3,000 to 4,000 kg.	3.25	2.50
	4,000 to 5,000 kg.	4.00	3 00
	over 5,000 kg.	4.75	3.50
	less than 2,000 kg.	2.25	1.50
Automobiles under 12 hp.	2 people	1.50*	1.00
	2 people	1.00	
	3 people	1.25	
	4 people	1.50	
Automobiles from 12 to 18 hp.	2 people	1.75*	1.25
	2 people	1.50	
	3 people	1.70	
	4 people	1 85	
	5 people	1 95	
	6 people	2 00	
Automobiles over 18 hp.	2 people	2.00*	1.50
	2 people	1.75	
	3 people	1.95	
	4 people	2.10	
	5 people	2.20	
	6 people	2.25	

	England
Heavy truck	2 70
Truck (1 500 kg.)	2.30
Automobile	1.55
Sidecar	0 50

* When only for one kilometer

Experimental Types Ordered by Army

That the Air Service of the Army has been developing in cooperation with the airplane manufacturers of the country types of airplanes in advance of any in the service at the present time is evidenced by the letting of contracts for designs for five different military airplanes.

The specifications for these designs were sent to airplane designers and manufacturers on September 15 and the bids were opened on November 15 Bidders were allowed to compete on one or more types. As submitted, the designs were accompanied by an accurate scale three-view drawing of the design on which bid was submitted, an itemized weight schedule, a balance diagram and schedule; proposed structural strength of the airplane; estimated performance of the airplane and drawings showing installation of all armament, equipment, instruments and accessories Detail drawings were not desired but the location of all accessories were to be clearly shown.

The amounts offered for the designs varied from $2,500 to $4,500 For type III—$2,500 for each of the three most satisfactory designs; for type VI—(Single engined) $4,000 for each of the two most satisfactory designs; for type VI—(Multi-engined) $4,500 for each of the two most satisfactary designs; for type XI—$3,500 for each of the three most satisfactory designs, for type XII—$5,000 for each of the three most satisfactory designs.

The awards have been made by the Engineering Division of the Air Service at McCook Field and it is believed that contracts for the construction of some of these types will be given to manufacturers in the near future.

Type III

Awards for this design have been made to
Curtiss Aeroplane and Motor Corp.
Loening Aeronautical Engineering Corp,
James V. Martin.

The characteristics of Type III may be summarized as follows.

The airplane may be either monoplane or biplane, and either internally or externally braced. The fuselage shall be constructed of steel tubing, while the wings may be of wooden construction, except that struts shall be steel and a single N-strut, which will permit adjustment for incidence, shall be used if a biplane with external bracing is designed. The design shall take care of the probability of metal wings being ordered later, if design submitted provides for wooden wings.

The airplane shall be designed for an air-cooled radial engine to take either of two designs now under construction. The weight of either engine may be taken as 800 lb., the horsepower at 350 The total gasoline capacity will be 418 lb. and oil 67.5 lb.

Type VI (Single Engine)

Awards for this design have been made to:
Boeing Airplane Co
Curtiss Aeroplane and Motor Corp.

The characteristics of Type VI (Single Engine) are intended to represent the development of the GAX airplane designed and built at McCook Field.

The earlier design was criticised as having poor vision, excessive weight of armor necessary, poor communication between gunners, pilot and target, and cramped space for gunners, not permitting necessary freedom.

In the development of the new design it was intended to give wide latitude to designers. The airplane could be a monoplane, biplane or triplane. The fuselage could be of metal construction, while the wings could be of wooden construction, in which case the design shall take care of the probability of metal wings being ordered later With reference to the armor protection, armor providing protection on bottom will weigh 10 lb. per square ft., and on side 7½ lb. per sq. ft., but it was not intended to limit in any way the arrangement or choice of armor or other method of protection.

The airplane shall be designed for the Engineering Division's 700 hp model "W" engine. The weight of this engine may be taken at 1800 lb.

Type VI (Multi-Engined)

The awards for the design of this type have been made to:
G Elias and Bro
Loening Aeronautical Engineering Corp

The airplane was designed for two or more of the following engines Liberty 12, Packard 500, or Engineering Division's 700 hp model "W" engine. The general suggestions made for the single-engined airplane of this type apply to the multi-motored design.

Type XI

The awards for this design were made to:
Boeing Airplane Co
Galladdet Aircraft Corp.
L W F Engineering Co.

This type could be either monoplane or biplane, and either internally or externally braced.

The fuselage could be constructed of metal, while the wings may be of wooden or metal construction. The airplane was designed for the Engineering Division's model "W" engine. The weight of this engine may be taken at 1500 lb, the horsepower as 700 at 1700 r p m. The total fuel capacity was to be 1490 lb and oil 210 lb

Type XII

The awards for this design were made to:
Aeromarine Plane and Motor Co.
Boeing Airplane Co
Curtiss Aeroplane and Motor Corp.

The airplane is to be an internally braced monoplane, to be constructed of steel or duralumin The power plant consists of 3 Liberty-12 engines. The proposal shall include bids for (a) construction of wing structure including such installations as are included in the wing structure; (b) construction of remainder of airplane, i. e., fuselage,tail group, landing gear, and tail skid, together with such installations as are included in these units

It was desired to let contracts to bidders selected from among those whose designs promise the best results Each contract will be upon a fixed-price base and will follow the form now in use by the Engineering Division, Air Service, which includes, inter alia, the following conditions

(a) That before commencing the construction of the first airplane, the contractor will be required to build a mock-up of the type of airplane proposed to be constructed This mock-up will be subject to inspection and approval by the Engineering Division. This mock-up must show the cockpits and all installations of (1) engine, including cowling, fuel and lubricating systems; (2) armament; (3) equipment, instruments and accessories; and (4) all airplane, engine and other controls. All pieces of cowling used in the mock-up must be cut to shape and proper form, and all structural members must be accurate as to size and location. The quality and kind of materials used is not important. If actual engine, armament, equipment and accessories are not available, dummies thereof, correct in dimensions, will be furnished by the government free of cost.

(b) That the first airplane will be for physical inspection and static load tests. The armament, power plant, instruments and other accessories must be installed in it, but certain refinements of finish and design may be omitted. The second airplane is for performance tests and it must be complete with armament, power plant, instruments and other accessories The assembly of this airplane must be held back by the contractor not to exceed thirty days after delivery of the first, to permit incorporation of any changes which appear necessary or advisable from the physical inspection and static tests of the first. The third airplane must also be complete with armament, power plant, instruments and other accessories and is intended to be a finished sample. Its assembly must be held back by the contractor for not to exceed thirty days after the delivery of the second, to permit the

incorporation of any changes which appear necessary or advisable, from the tests of the first two. No payment will be made to the contractor for any change or alteration in any airplane which does not affect the basic design and which is made in any unassembled article during any of the periods during which the contractor agrees to hold back assembly. The cost of such other changes and alterations as are ordered by the government in the airplane, will be covered by an agreement suppplemental to the contract, upon a fixed-price basis.

(c) That the contractor must also furnish a final analysis of design, a complete set of experimental working drawings and a bill of materiel, all of the third airplane, to be in the form of Van Dykes. These shall be delivered within sixty days after the delivery of the third airplane. A complete set of experimental working drawings is defined as those drawings from which the third airplane has been constructed. They must embrace the alterations and changes made in this airplane and contain no obsolete data. Sketches will not suffice but drawings to a definite scale must be provided. These working drawings need not be detailed drawings in the sense that they must give a detail of every part of the airplane, but should consist of approximately 300 to 400 separate prints, from which an experimental constructor of airplanes could reproduce the airplane in limited quantities.

(d) The government will furnish, without cost to the contractor, the armament, engines, instruments and standard accessories mentioned in the specifications, and will endeavor to furnish such raw materials as are not readily available, at prices approximating cost to the government.

(e) That partial payments will be made to the contractor as the work progresses.

(f) That the contract must be accompanied by an approved surety bond in duplicate for 20 per cent of the amount of the contract.

(g) That all airplanes contracted for must be delivered in good condition by the contractor, f.o.b. the headquarters of the Engineering Division, Air Service, where each will be tested by this Division and accepted or rejected according to the terms of the contract. The specifications prescribe the tests. Contracts will allow the contractor an agreed time within which to modify and rectify any rejected airplane, with a view to making the same acceptable to the government.

(h) That the government may terminate the contract at any time by compensating the contractor in accordance with the standard provisions of Engineering Division contracts.

Japanese Air Mail Progress

The Japanese government has completed all arrangements for the early inauguration of a comprehensive air mail service throughout Japan. With characteristic thoroughness and attention to detail official reports have been prepared dealing with every phase of the aviation industry in Japan as well as statistics relating to pilots, aerodromes and suitable landing places. Airplanes capable of carrying four passengers in addition to mails and up to 600 lb. of freight are said to be recommended for adoption by Mr. Ayamada of the Japanese Transport Department who was commissioned to study European methods of commercial aviation. Tokio and Osaka are expected to be the first cities to be put into regular communication by air and the Japanese Imperial Aviation Society is to be entrusted with the inauguration of all the new air routes.

Post Field to Fabricate Complete Spherical Balloon

The Balloon and Airship personnel of the U. S. Air Service at Post Field, Fort Sill, Okla., has planned to fabricate a complete spherical balloon. The work is to be done by the enlisted men of the field under the direction of the officers. The balloon will be made of salvaged materials. The men will select the fabrics, test them, cut them, fit them, and assemble them in the finished balloon. Further than this it is planned to make a net for the balloon with all the difficulties of rigging-assembly which that entails.

This balloon is expected to fly in regular free balloon service. The man who flies in that balloon, knowing that it is a product of his work and that of his associates, will appreciate what a thorough knowledge of essential details means.

Aeronautical Progress in Indiana

In the past year there has been a great public educational movement in Indiana in regard to aeronautics, started by the Curtiss Indiana Co. of Kokomo, and as many as twenty thousand persons have had rides in airplanes which this company has sent broadcast over the State. The company was organized primarily to promote the distribution of Curtiss airplanes, and includes on its board of directors, Elwood Haines of the Haines Automobile Co., and many prominent Kokomo men. The company is under the direct management of Lieut. W. M. Fagley.

Besides a fine flying field and hangars, near the Kokomo Country Club, the company has established a service department handling a complete line of Curtiss parts. It also has organized a system of flying clubs in cities throughout the state, which enables the person of average income and ordinary physique to become part owner in an airplane hangar and to receive thorough flying instruction.

Aero Club of New England Elections

The Aero Club of New England held its monthly meeting in the City Club, Boston November 23, with President Godfrey L. Cabot presiding and about 30 members and guests attending. Rear Admiral Stanley S. Robison, commandant at the Boston Navy Yard, and Maj. Gen. David C. Shanks, commander of the 1st Army Corps area, talked on development of aviation in the military and naval service. Parker H. Kemble, a director of the club, gave an illustrated talk.

The following officers were elected: Godfrey L. Cabot, president; Josiah S. Hathaway and J. Walter Flagg, vice presidents; William Carroll Hill, secretary; Alfred R. Shrigley, treasurer; Godfrey L. Cabot, J. Walter Flagg, Charles J. Glidden, Josiah S. Hathaway, William Carroll Hill, Henry Howard, Alfred R. Shrigley, Nelson H. Smith, Carl E. Shumway, John J. Van Valkenburgh, Parker H. Kemple and Cyrus H. Stowell, directors.

Spokane News

The newest development in aviation in the Spokane territory is a plan to establish commercial flying between Spokane and Seattle. The United States Aircraft Corporation is behind the plan. It expects to use rebuilt DeHaviland machines equipped with 400 hp. Liberty engines. Each plane will have a carrying capacity of six or more passengers. The company has 14 pupils enrolled at its aviation school, one being a Japanese entered by the government of Japan.

The company intends to develop aerial photography and make trips over the national parks, taking moving pictures while flying. Release will be made through the Pathe weekly news service. Arrangements for this have already been made. A service of photographing cities or making views of any commercial concern's place, or picturing tracts of land will be available.

German Aero Clubs Combine

The Aero clubs of Kurhessen, Gross Thuringen and Saxony have combined to form a national aviation society. The inaugural meeting took place at Cassel in Prussia, and was largely attended by delegates from many district councils and representatives of important manufacturing and commercial interests. A resolution was unanimously accepted pledging the members to prevent by all possible means the investment of foreign capital in German air transport companies. The headquarters of the new society are at Cassel.

Greensboro N. C.-New York Flight

Pilot Charles W. Meyers of East Orange, N. J., recently made a creditable flight from Greensboro, N. C., to New York, a distance of slightly over 500 miles in 6 hrs. and 20 min. flying time. He used a Canadian Curtiss equipped with an OX-5 motor, and carried as a passenger John Davis of Greensboro.

During the past season Mr. Meyers has used the machine flying in Alabama, Georgia, South Carolina and North Carolina.

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STRENGTH **REPUTATION** **SERVICE**

"You can imagine our wild delight as we kept gaining until finally we passed . . . . about sundown and were four miles ahead when night came, grey black."

* * * *

Here is a paragraph from a tale that a pilot told. He describes his part in the recent International Balloon Race, from Birmingham, Alabama, north. He pictures vividly the thrills of this peace-time adventure, when men adrift under gas bags strove for mileage as-the-crow-flies. To win, they were dependent upon great good judgment, upon ballast and upon the will of the winds.

* * * *

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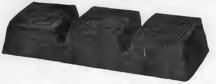

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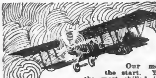

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